Institution: Liverpool John Moores University

Unit of Assessment: UOA25 Education

Title of case study: The Use of Semantic Web Technologies developed for Teaching and Learning

1. Summary of the impact

Our research explored the ways the emerging Semantic Web can support teaching and learning. It identified case based learning as a key area and outputs were used to enhance the unique research council funded Economic and Social Data Service public collections and pioneers pages. Results informed the thinking of accountancy bodies on e-assessment via the Association of Chartered Certified Accountants/International Association for Accounting Education. An exemplary user case study derived from the research was selected by World Wide Web Consortium (W3C). The research supported the aggregation and presentation of Open Educational Resources via JISC. Project software and documentation was released as open source. Outcomes provided the 'Liverpool, City of Radicals' Project timeline.

2. Underpinning research

Ensemble research explored the potential of the emerging 'Semantic Web' to support teaching and learning in complex, controversial and rapidly-evolving fields where case based learning is the pedagogical approach of choice. This involves working with teachers and students in undergraduate and postgraduate courses to explore both the nature and role of the cases around which learning is focused, and the part that emerging web technologies and techniques can play in supporting this learning.

The research expanded in scope beyond the development and implementation of learning technologies, furthering academic and practitioner debates about the ethical framings of interdisciplinary, participatory research [1] and the processes by which educational systems develop, institutions respond to change and the barriers they face [3,5]. It provided answers to substantive questions about how best to theorize the practices and discourses which accompany the use of technologies (broadly defined) in learning [6], drawing on media, post-structural, spatial and network theories.

The project influenced education; computer science; and interdisciplinary and participatory approaches to learning technology design. The project developed frameworks contributing to wider debates about the development, deployment and evaluation of learning technologies. The project documented 'case pedagogies' in areas from sciences to performing arts. This provided better understandings about the critical role of 'mediating pedagogies' which supported activity in curriculum redesign, technology deployment and assessment.

The Ensemble research team (RES-139-25-0403-A £749,310.74) included Professor Patrick Carmichael, Principal Investigator (October 2009 – May 2012), Dr Frances Tracy, Research Associate (October 2009 - December 2010), Dr Kate Litherland, Research Assistant (January 2011 – July 2013), Agustina Martinez-Garcia, Research Associate (October 2009 - March 2010 1FTE; April 2010 – May 2013 0.2FT, May – July 2013 1 FTE), and Simon Morris, Software Developer (June 2010 – July 2013). The research continued beyond the grant period supported by external grants and core funding. The work from January 2011 until July 2013 included contributions from Frances Tracy (Senior Lecturer LJMU December 2010 – July 2013) and Professor Christopher Jones (October 2012 to July 2013).

Outputs contributing to research impact (articles listed below) were aimed at academic and practitioner audiences. Research explored different models of case-based learning in diverse undergraduate and postgraduate settings from biosciences to contemporary dance [see reference 5]. It involved the development of novel approaches using participatory design and rapid prototyping [4] to develop software applications that combine digital repositories and descriptive

and semantic metadata [2], and drew on the expressive power of emerging 'rich web' applications and visualisation tools [5] to offer teachers and students opportunities to engage with, construct and reconstruct cases in ways that respond to their distinctive pedagogies, practices and discourses. The method challenged conventional approaches to the design of educational software applications and platforms by involving and engaging with teachers and students in the design and development of software which then supported activities that were personally important or significant within disciplinary and professional communities, [3, 4].

The research initially focused on the applications of these technologies and approaches in formal education settings and its work extended into professional learning settings (Accounting and Finance professionals; Curators and Archivists) and public engagement with existing collections (City of Radicals) and social scientists interested in analysis of complex data (DDI).

3. References to the research

The outputs below are specific to the ESRC/EPSRC Technology Enhanced Learning Programme project "Ensemble: Semantic Technologies for the Enhancement of Case Based Learning" (RES-139-25-0403A, 2009-2011 £749,310.74). All outputs are fully peer reviewed.

1**. Tracy, F**. and **Carmichael, P.** (2010) Research Ethics and Participatory Research in an Interdisciplinary Technology-Enhanced Learning Project, *International Journal of Research and Method in Education,* 33(3), pp. 245–257
2. **Carmichael, P.** (2011) Research Capacity Building in Education: the Role of Digital Archives, *British Journal of Educational Studies*, 59(3), pp. 323-339
3. **Carmichael, P.** and **Litherland, K.** (2012) 'Transversality and Innovation: Prospects for Technology-Enhanced Learning in Times of Crisis' in Cole, D. (ed.) *Surviving Crises through Education* (New York, Peter Lang), pp. 95-114
4. **Tracy, F**. and Jordan, K. (2012) Students as Designers of their Own Learning Technologies, *Technology, Pedagogy and Education,* 21(2), 171-188 doi:10.1080/1475939X.2012.696789
5. **Martinez-Garcia, A., Morris, S**., **Tracy, F.,** Tscholl, M. and **Carmichael, P.** (2012) 'Case Based Learning, Pedagogical Innovation and Semantic Web Technologies' IEEE Transactions on Learning Technologies. Online at:
http://www.computer.org/portal/web/csdl/doi/10.1109/TLT.2011.34
6. Edwards, R., **Tracy, F.** and Jordan, K. (2011) Mobilities, Moorings and Boundary Making, *Research in Learning Technologies*, 19(3), pp. 219-232. doi: 10.1080/21567069.2011.624167

4. Details of the impact

The project has presented its work to reach audiences beyond higher education research (accountants, digital content providers, schoolteachers) and organised symposia and workshops offering hands-on experience of using project software tools. Release of software 'open source', the provision of case studies, technical demonstrators, prototypes and documentation, and hands-on workshops and dissemination events, promoted the adoption of project technologies and approaches amongst non-academic and general web users of the Semantic Web. The www.ensemble.ac.uk site had 112 comments posted to its pages and the ensemble@ljmu blog has had 3583 visits, with over 17% of views originating outside the UK (25th September 2013).

Key impacts:

1. Digital Content Providers interested in improving public engagement with online content e.g.The Economic and Social Data Service (now the UK Data Service) adopted project approaches and technologies to enhance their public collections and Pioneers pages. The UK Data Service is a comprehensive resource funded by the ESRC to support researchers, teachers and policymakers. Web analytics show an increase from 774 views (of the original Pioneers web pages - Oct 2008 to Dec 2011) to 7870 visits, of which 2210 have been to the Simile based Ensemble designed pages (new Pioneer web pages Dec 2011 - October 2013). Analytics show the Pioneers pages are the second most visited page after the home page. (http://www.ukdataservice.ac.uk/use-data/data-in-use.aspx, Case Studies; http://ukdataservice.ac.uk/teaching-resources/pioneers.aspx).

2. Association of Chartered Certified Accountants (154,000 members and 432,000 students in 170 countries) and the International Association for Accounting Education (50 institutional members, including professional accounting bodies) benefited from work on e-assessment that proved the concept that automation to discern broad categories of responses was possible and that it could support markers in making more consistent judgements. Grant award of £16,000 from the International Association for Accounting Education and Research (2011-2012)
3. The World Wide Web Consortium (W3C), the organisation that defines web standards, selected the Ensemble's Contemporary Dance case study as a non-technical exemplar of Semantic Web technologies in practical use. The case went live in November 2012 and was reported in Semantic Web Activity News: "New SW Case Study by the Liverpool John Moores University" (http://www.w3.org/blog/SW/2012/11/), Planet Semantico (http://www.semanticaweb.info/category/sw-deployment/) and Next Web (http://red.gnoss.com/en/community/nextweb/resources#sioc_t:Tag=teaching%20of%20dance). It was also reported on Scoop.it (http://www.scoop.it/t/artificial-intelligence-for-students/p/3479915868/case-study-using-the-semantic-web-to-enhance-the-teaching-of-dance)

Other impacts:

- Web users benefited from the open source extension of the SIMILE Exhibit web application framework; from detailed educational use cases based on project examples (e.g. W3C dance case study). These permit non-experts to amend semantic data without degrading its integrity and to innovatively link semantic data to timeline based media such as video (e.g. City of Radicals timeline). The latter has potential impact for BBC Learning (3 exploratory meetings 2011-2012-2013).
- The Digital Archive Community - Those working on the Data Documentation Initiative, benefited from participation in the Qualitative Data Exchange working group. Ensemble provided educational and social science research use cases, models and new archiving tools. This led to a shift from archiving models entirely based on data curation and storage to a model underpinned by the qualitative research processes.
- A Teacher Agency ICT grant ('Linked Data for School Science' 2012-2013 £5,000) involved training ITE students and secondary school science teachers (2012/2013) in three schools using Ensemble work on linked data and video. The training enabled trainee teachers to plan to use technology in their future teaching and existing teachers to find strategies to cope with new expectations of technology use. A YouTube video (developed by the project following its work in 3 schools) has been viewed 876 times in 6 months; 21.5% from the UK, 18.4% from the USA, 13.1% from the Netherlands, and evidence of its use can be seen in following comments: - http://octel.alt.ac.uk/forums/topic/b-f-skinner-and-the-teaching-machine-tablet-edition/; https://twitter.com/ProfDanielMuijs/status/329982905663246336; http://www.scoop.it/t/globalization-learning-and-literacy/p/3998840644/b-f-skinner-and-the-teaching-machine-tablet-edition; https://annotary.com/collections/15490/ipads-LLY
- Innovative work with the Semantic Web and video, was donated as open source code to MIT's Exhibit project software repository hosted by Google (e.g. FELIX flexible lightweight editor for exhibit and JSON-X http://www.ensemble.ac.uk/wp/technologies) and it was the foundation of a JISC funded project (see below). The resulting tool enabled narrative to be associated with semantic data and the tool has been registered for use by academics in seven separate HE institutions, and two schools.
- A JISC funded project, (£25,000) part of the OER Rapid Innovation strand (April – October 2012) contributed to the aggregation and presentation of Open Educational Resources and created a user friendly tool for non-technical users to create Semantic Web pages with minimal knowledge of the software frameworks that underpinned semantic faceted browsing. It was given the name AutoKitty. The AutoKitty, open source software developed by the project and available via a repository, has had 26 downloads (25th September 2013).

5. Sources to corroborate the impact

References

1. The Associate Director UKDA can provide a reference for the impact of the Ensemble project in developing the case studies and pioneers pages.
2. The Executive Director for Learning and Products for the Association of Chartered Certified Accountants who also sits on the International Accounting Education Standards Board can provide evidence of impact on accountancy education.
3. The Semantic Web Activity Lead at the World Wide Web Consortium (W3C) can provide a reference for the selection of the case study.
4. The Computer Science and Artificial Intelligence Laboratory in the Department of Electrical Engineering and Computer Science at MIT (USA) can provide a reference for the impact of the research on the semantic web developer/programmer community
5. Data Documentation Initiative (DDI) Alliance can provide evidence of how the user requirements of education researchers and other social scientists (teachers and students) from the Ensemble project and Martinez Garcia's PhD have informed (by providing rich use cases) work in qualitative research data archiving, specifically a DDI working group implementing an XML schema for qualitative data exchange (compliant with DDI).
6. The EU FP7 Projects 'Brainable' and 'FutureBNCI' (and their UK partners, the charity 'AbilityNet') on the use of Ensemble project technologies and design approaches to support their research, dissemination and training activities.
7. BBC Commissioner (Salford) can provide evidence of how the technologies developed during the research have the potential to be used by BBC Learning
8. The Bluecoat Arts Centre, on the use of technologies and pedagogical design in the 'Liverpool, City of Radicals' Project
9. Dean at UT Sydney and Director of the 'Remaking Practice' project in Australia can provide evidence of research impact in professional learning in health settings
10. Head teacher, Ormiston Bolingbroke Academy, Halton, Merseyside.